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CALCULATION OF EFFICIENT USE OF CHINESE FREIGHT CARS ON BASIS OF TURNAROUND TIME

/This report summarizes the salient points of an article by Wu Ying-lun concerning the use of turnaround time as a basis for judging freight car utilization. It includes the specific data given in the original report for purposes of illustration./

The Railway Administration of the People's Republic of China attaches much importance to advance planning of rail transport, in which the method of measuring performance becomes a prime point. It is generally accepted that turnaround time /TRT/ is inseparably involved in this matter.

Under the former political regime, judgment as to the efficient use of rolling stock was based on the average daily car kilometrage. Since liberation, the judgment has been based on the turnaround time, expressed in terms of days and decimals thereof, which was defined as the quotient obtained by dividing the total number of cars in operation /COP/ by the daily work load /DWL/.

The following three formulas may be used for computing turnaround time. The first, or car-count formula, is as follows:

$$(1) \quad TRT = \frac{COP}{DWL}$$

The second, or time-count formula is calculated in the following manner. Turnaround time is equal to 1/24 of: turnaround distance /TRD/ divided by travel speed /TRVS/, plus turnaround distance divided by average switching distance /SWD/, multiplied by average switching time /SWT/, plus average number of cars loaded per day /CLD/ less average number of cars unloaded per day /CUN/ divided by the daily work load, multiplied by the stopping time /STPT/, as follows:

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$$(2)\quad TRT = 1/24\left(\frac{TRD}{TRVS} + \frac{TRD}{SWD} \times SWT + \frac{CLD - CUN}{DWL} \times STPT\right)$$

The third formula is actually the same as the second but "planned," instead of actual, figures are used in the calculation. In Formula (3), wherever the asterisk (*) occurs, it is to be understood that those figures are "planned" figures. Hence Formula (3) may be referred to as the "planned" turnaround-time formula.

$$(3)\quad TRT = 1/24\left(\frac{*TRD}{*TRVS} + \frac{*TRD}{*SWD} \times *SWT + \frac{*(CLD - CUN)}{DWL} \times *STPT\right)$$

Because of its simple characteristics, Formula (1) is regarded as most reliable, in providing a value for turnaround time closest to the true figure, hence it may be referred to as the "real" turnaround time. Formula (2) is often called the "actual" formula, since the data used is taken from actual operations. Formula (3) is the one in which railway administrators use "planned" figures. The "planned" figures are determined by past performance, but they also express the aims and objectives for future operations and thus become targets or goals.

For the last 2 or 3 years, the achievement of an individual railway or of an individual bureau, has been measured by making computations using Formula (2), that is, ascertaining the "actual" turnaround time, and then comparing it with that of Formula (3), the "planned" turnaround time. If (2) equals (3), the goal has been reached; if (2) is less than (3), the goal has been surpassed.

However, for a correct evaluation of achievement, for a true measure of efficiency in the use of the rolling stock, the "actual" turnaround time, (2), should be compared, not with the "planned" turnaround time, (3), but with the "real" turnaround time, (1). Formula (3) is not real, having been arrived at by the use of fictitious figures which may be far off with respect to actual traffic conditions. Erroneous conclusions may easily be drawn when comparing (2) with (3); namely, under certain conditions, if for X Bureau, (2) were greater than (3), it might be concluded that X Bureau had made a bad record in car utilization, whereas, on the contrary, its record in this respect might have been very good.

Following are two sets of figures to be employed in the formulas, with comments as to the proper conclusions to be drawn. These figures are those reported by a certain railway bureau for the month of November 1950.

	Planned Figures		Actual Figures	
Speed	17	km/hr	17	km/hr
Switching Time	4	hr	4	
Stopping Time	17	hr	17	hr
Turnaround Distance	563.8	km	460.0	km
Number cars loaded	604	cars	655	cars
Number cars unloaded	659	cars	663.36	cars
Loaded cars entering area	105	cars	99.4	cars
Daily Work Load	709	cars	754.4	cars

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	Planned Figures	Actual Figures
Switching Distance	140.95 km	175.96 km
Work Rate	--	1.75
Cars in operation	--	2,442.3 cars

The results of applying these figures in the proper formulas are:

$$(1)\quad TRT = \frac{2442.3}{754.4} = 3.24 \text{ days}$$

$$(2)\quad TRT = 1/24\left(\frac{480}{17} + \frac{480}{175.96} \times 4 + 1.75 \times 17\right) \quad 2.87 \text{ days}$$

$$(3)\quad TRT = 1/24\ \frac{563.79}{17} + \frac{563.79}{140.95} \times 4 + 1.75 \times 17\Big) \quad 3.31 \text{ days}$$

According to the above data, the actual daily work load was 45.4 cars greater than the planned daily work load; that is, 106 percent of the target. By using formula (1), the turnaround time was 0.07 days less than that found by using Formula (3) (3.31 - 3.24); that is, the achievement was 102 percent of the target. Superficially, it would appear that said bureau had more than achieved its task. However, the actual turnaround distance, 480 kilometers, compared with the planned turnaround distance, 563.8 kilometers, is smaller by 83.8 kilometers, and is only 85 percent of the planned turnaround distance. Furthermore, the turnaround time computed by Formula (1) is 0.37 days longer than that computed by Formula (2) (3.24 - 2.87). It may therefore be affirmed that although this bureau's turnaround time computed by Formula (1) using actual data, surpassed (3) in which planned figures were used, yet as regards the use of rolling stock, its performance should be rated as

$$\frac{(2)}{(1)} = \frac{2.87}{3.24} = 88.6 \text{ percent}$$

It is recommended that, hereafter, for purposes of judging the efficiency of freight car utilization by comparison of turnaround time, the "actual," (2), should be compared with the "real" (1) and not with the "planned" (3) turnaround time.

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